Snakes, the ecosystem, and us: it’s time we change

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Executive Summary: Snakes are often killed at sight, even if not venomous. Social and cultural connotations, some more negative than others, and fear of snakebite shape our attitudes towards snakes and lead to human snake conflict. But snakes play an important role in our ecosystem and provides us economic and therapeutic benefits. It is high time we now start valuing the importance of snakes in biodiversity to make our societies healthier.

Snakes, as serpent deities are revered in various cultures - as a symbol of fertility, rebirth, afterlife, medicine, healing and prosperity.[1-4] Paradoxically, in communities, they are also considered as a threat to life and livelihood. Ophidiophobia, the fear of the snakes, is one of the most common phobias of animals (affecting 2-3% human population).[5, 6] Snakes are often killed on sight, for fear of snakebite.

Globally, up to 138,000 people die due to snakebite every year with nearly 2.7 million people suffering serious injuries and permanent disabilities.[7] However, about 85-90% of snakes species worldwide are non-venomous.[8] Most snakes are not aggressive in nature, and often bite in defence, or when threatened or provoked.[9] Killing snakes for fear of snakebites is problematic – as decreased snake population is detrimental not only for the environment but also for humans. Snakes serve critical role as predators, as preys, as ecosystem engineers, and provide economic and therapeutic benefits to humans (Figure 1).

Figure 1: The existence and importance of snakes in the ecosystem and our life
Snakes as predators, feed on frogs, insects, rats, mice, and other rodents, helping to keep prey population under control. Snakes are also eaten by other species - thus playing a key role in the food-chain as prey. Skunks, mongooses, wild boars, hawks, snake eagles, falcons, and even some snake-species are Ophiophagus, i.e. species who feed on snakes as their primary diet.[10-12] The king cobra (Ophiophagus hannah), eastern king snake (Lampropeltis getula), black-headed python (Aspidites melanocephalus), eastern indigo snake (Drymarchon couperi) are some ophiophagus snakes.[13-15] Declining snake population not only effects ophiophagus species, but has effects across many trophic levels. A disrupted ecosystem in the context of climate change, an increased probability of natural disasters has the potential to cause massive loss of life and livelihood.[16-18] The declining population of snakes has been documented globally.[19]

Snakes as ‘ecosystem-engineers’ facilitate ‘secondary seed dispersal’, thus contributing to reproduction of plants.[20-22] When snakes swallow rodents (who consume seeds), the seeds are expelled through excretion into the environment in an intact manner. As snakes have larger home ranges than rodents, seeds tend to disperse at greater distances from the parent plant.[23] This mechanism supports growth and survival of plant species without struggling for common resources of light, water, and soil nutrients and hence essential for biodiversity and ecological restoration.[24]

Snakes also play a role in disease prevention and provide benefits to agricultural communities. Rodents are carriers of many zoonotic diseases (like Lyme disease, leptospirosis, leishmaniasis, hantavirus) which affects humans, dogs, cattle, sheep, and other domestic animals.[25-28] A sudden increase in rodent population might lead to zoonotic diseases outbreaks.[29]. Increase in population of rodents leads to loss of crops.[30] By eating rodents, snakes keep the population of rodents under control, thus preventing zoonotic disease transmission, and contributing to food security.[31] Estimates suggest that nearly 200 million people can be fed by food grains that are destroyed by rodents every year.[30] Offering natural, environmental-friendly, and free service to mitigate against rodents, snakes are truly “farmer’s friends”.[32]

Snakes are also a source of many medicines. The only proven and effective therapy for snakebite - the snake-anti venom, is also derived from snake venoms.[33] Snake venom is injected into horses and sheep. The animals’ plasma with antibodies against the venom is collected and purified to produce the life-saving, snake anti-venom. [34] Snake venom has therapeutic value beyond anti-venom production. Many drugs derived from snake venoms are used in clinical practice (Table 1). [35-38] However, the therapeutic potential of snake venoms remains unexplored. Venom researchers continue to discover and investigate many more compounds.

With the effects of climate change now evident, it is time now to start valuing the importance of biodiversity in making our societies healthier. Let’s save the snakes!

**Table 1: Snake venom derived drugs which are approved for clinical use [35-39]**

<table>
<thead>
<tr>
<th>Snake species</th>
<th>Name of Drug</th>
<th>Disease / Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jararaca pit viper snake (Bothrops jararaca)</td>
<td>Captopril, Enalapril</td>
<td>Hypertension; Cardiac failure</td>
</tr>
<tr>
<td>Saw-scaled viper (Echis carinatus)</td>
<td>Tirofiban</td>
<td>Acute coronary syndrome; Unstable angina</td>
</tr>
<tr>
<td>Brazilian lancehead snake (Bothrops moojeni)</td>
<td>Batroxobin</td>
<td>Autologous fibrin sealant in surgery</td>
</tr>
<tr>
<td>Chinese cobra (Naja naja atra)</td>
<td>Cobratide</td>
<td>Chronic arthralgia; sciatica; neuropathic headache</td>
</tr>
<tr>
<td>South-eastern Pygmy Rattlesnake (Sistrurus miliarius barbourin)</td>
<td>Eptifibatide</td>
<td>Acute coronary syndrome, percutaneous coronary intervention</td>
</tr>
</tbody>
</table>
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